

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims:

1. (Currently Amended) A method of treating a subterranean formation comprising:
providing a servicing fluid comprising a ~~reduced-density~~ particulate having a density, a surface, and a coating, wherein the surface comprises a porous or partially hollow geometry and the coating is capable of trapping a fluid between the surface and the coating; and
allowing a fluid to be trapped between the surface of particulate and the coating
so that the density of the particulate is reduced; and
introducing the servicing fluid into the subterranean formation.
2. (Original) The method of claim 1 wherein the coating comprises a resin-type coating material.
3. (Original) The method of claim 2 wherein the resin-type coating material is a consolidation fluid comprising a hardenable resin component comprising a hardenable resin and a hardening agent component comprising a liquid hardening agent, a silane coupling agent, and a surfactant.
4. (Previously Presented) The method of claim 3 wherein the hardenable resin in the liquid hardenable resin component is an organic resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolak resin, polyester resin, phenol-aldehyde resin, urea-aldehyde resin, furan resin, urethane resin, glycidyl ethers, and mixtures thereof.
5. (Previously Presented) The method of claim 3 wherein the liquid hardening agent in the liquid hardening agent component is selected from the group consisting of amines, aromatic amines, aliphatic amines, cyclo-aliphatic amines, piperidine, triethylamine, benzyldimethylamine, N,N-dimethylaminopyridine, 2-(N₂N-dimethylaminomethyl)phenol, tris(dimethylaminomethyl)phenol, and mixtures thereof.
6. (Previously Presented) The method of claim 3 wherein the silane coupling agent in the liquid hardening agent component is selected from the group consisting of N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane and mixtures thereof.

7. (Previously Presented) The method of claim 3 wherein the surfactant in the liquid hardening agent component is selected from the group consisting of ethoxylated nonyl phenol phosphate esters, mixtures of one or more cationic surfactants, C₁₂ – C₂₂ alkyl phosphonate surfactants, one or more non-ionic surfactants and alkyl phosphonate surfactants, and mixtures thereof.

8. (Previously Presented) The method of claim 2 wherein the resin-type coating material is a furan-based resin selected from the group consisting of furfuryl alcohol, a mixture furfuryl alcohol with an aldehyde, a mixture of furan resin and phenolic resin and mixtures thereof.

9. (Previously Presented) The method of claim 8 further comprising a solvent selected from the group consisting of 2-butoxy ethanol, butyl acetate, furfuryl acetate, and mixtures thereof.

10. (Previously Presented) The method of claim 2 wherein the resin-type coating material is a phenolic-based resin selected from the group consisting of terpolymer of phenol, phenolic formaldehyde resin, a mixture of phenolic and furan resin, and mixtures thereof.

11. (Previously Presented) The method of claim 10 further comprising a solvent selected from the group consisting of butyl acetate, butyl lactate, furfuryl acetate, 2-butoxy ethanol, and mixtures thereof.

12. (Previously Presented) The method of claim 2 wherein the resin-type coating material is a HT epoxy-based resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolac resin, polyester resin, glycidyl ethers, and mixtures thereof.

13. (Currently Amended) The method of claim 12 further comprising a solvent selected from the group consisting of dimethyl sulfoxide, dimethyl formamide, dipropylene glycol methyl ether, dipropylene glycol dimethyl ether, dimethyl formamide, diethylene glycol methyl ether, ethylene glycol butyl ether, diethylene glycol butyl ether, propylene carbonate, ~~d-limonene~~ d-limonene, fatty acid methyl esters, and mixtures thereof.

14. (Original) The method of claim 1 wherein the coating comprises a tackifying coating material.

15. (Previously Presented) The method of claim 14 wherein the tackifying coating material is selected from the group consisting of polyamides, polyesters, polycarbonates, polycarbamates, natural resins, and combinations thereof.

16. (Original) The method of claim 1 wherein the coating comprises a degradable coating material.

17. (Original) The method of claim 16 wherein the degradable coating material comprises a degradable polymer.

18. (Previously Presented) The method of claim 17 wherein the degradable coating material is selected from the group consisting of polysaccharides, chitins, chitosans, proteins, aliphatic polyesters, poly(lactides), poly(glycolides), poly(ϵ -caprolactones), poly(hydroxybutyrates), poly(anhydrides), aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), polyphosphazenes, and combinations thereof.

19. (Original) The method of claim 17 wherein the degradable coating material comprises a stereoisomer of poly(lactide).

20. (Original) The method of claim 17 wherein the degradable coating material comprises a plasticizer.

21. (Currently Amended) A method of fracturing a subterranean formation comprising:

providing a fracturing fluid comprising at least a reduced-density particulate plurality of particulates having a density, a surface, and a coating, wherein the surface comprises a porous or partially hollow geometry and the coating is capable of trapping a fluid between the surface and the coating;

allowing a fluid to be trapped between the surface of particulate and the coating so that the density of the particulate is reduced;

introducing the fracturing fluid into the subterranean formation at a pressure sufficient to create or enhance at least one fracture therein; and

removing the fracturing fluid while leaving at least ~~a portion of the reduced-density particulate~~ one of the particulates in the fracture.

22. (Original) The method of claim 21 wherein the coating comprises a resin-type coating material.

23. (Original) The method of claim 22 wherein the resin-type coating material is a consolidation fluid comprising a hardenable resin component comprising a hardenable resin and a hardening agent component comprising a liquid hardening agent, a silane coupling agent, and a surfactant.

24. (Previously Presented) The method of claim 23 wherein the hardenable resin in the liquid hardenable resin component is an organic resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolak resin, polyester resin, phenol-aldehyde resin, urea-aldehyde resin, furan resin, urethane resin, glycidyl ethers, and mixtures thereof.

25. (Previously Presented) The method of claim 23 wherein the liquid hardening agent in the liquid hardening agent component is selected from the group consisting of amines, aromatic amines, aliphatic amines, cyclo-aliphatic amines, piperidine, triethylamine, benzyldimethylamine, N,N-dimethylaminopyridine, 2-(N₂N-dimethylaminomethyl)phenol, tris(dimethylaminomethyl)phenol, and mixtures thereof.

26. (Previously Presented) The method of claim 23 wherein the silane coupling agent in the liquid hardening agent component is selected from the group consisting of N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane and mixtures thereof.

27. (Previously Presented) The method of claim 23 wherein the surfactant in the liquid hardening agent component is selected from the group consisting of ethoxylated nonyl phenol phosphate esters, mixtures of one or more cationic surfactants, C₁₂ – C₂₂ alkyl phosphonate surfactants, one or more non-ionic surfactants and an alkyl phosphonate surfactant, and mixtures thereof.

28. (Previously Presented) The method of claim 23 wherein the resin-type coating material is a furan-based resin selected from the group consisting of furfuryl alcohols, mixtures of furfuryl alcohol with an aldehyde, mixtures of furan resin and phenolic resin and mixtures thereof.

29. (Previously Presented) The method of claim 23 further comprising a solvent selected from the group consisting of 2-butoxy ethanol, butyl acetate, furfuryl acetate, and mixtures thereof.

30. (Previously Presented) The method of claim 23 wherein the resin-type coating material is a phenolic-based resin selected from the group consisting of terpolymer of phenol, phenolic formaldehyde resin, a mixture of phenolic and furan resin, and mixtures thereof.

31. (Previously Presented) The method of claim 30 further comprising a solvent wherein the solvent is selected from the group consisting of butyl acetate, butyl lactate, furfuryl acetate, 2-butoxy ethanol, and mixtures thereof.

32. (Previously Presented) The method of claim 22 wherein the resin-type coating material is a HT epoxy-based resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolac resin, polyester resin, glycidyl ethers, and mixtures thereof.

33. (Currently Amended) The method of claim 21 further comprising a solvent selected from the group consisting of dimethyl sulfoxide, dimethyl formamide, dipropylene glycol methyl ether, dipropylene glycol dimethyl ether, dimethyl formamide, diethylene glycol methyl ether, ethylene glycol butyl ether, diethylene glycol butyl ether, propylene carbonate, ~~d-limonene~~ d-limonene, fatty acid methyl esters, and mixtures thereof.

34. (Original) The method of claim 21 wherein the coating comprises a tackifying coating material.

35. (Previously Presented) The method of claim 34 wherein the tackifying coating material is selected from the group consisting of polyamides, polyesters, polycarbonates, polycarbamates, natural resins, and combinations thereof.

36. (Original) The method of claim 21 wherein the coating comprises a degradable coating material.

37. (Original) The method of claim 36 wherein the degradable coating material comprises a degradable polymer.

38. (Previously Presented) The method of claim 37 wherein the degradable coating material is selected from the group consisting of polysaccharides, chitins, chitosans, proteins, aliphatic polyesters, poly(lactides), poly(glycolides), poly(ϵ -caprolactones), poly(hydroxybutyrates), poly(anhydrides), aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), polyphosphazenes, and combinations thereof.

39. (Original) The method of claim 37 wherein the degradable coating material comprises a stereoisomer of poly(lactide).

40. (Original) The method of claim 37 wherein the degradable coating material comprises a plasticizer.

41. (Currently Amended) A method of installing a gravel pack comprising:
providing a gravel packing fluid comprising at least a reduced-density particulate plurality of particulates having a density, a surface, and a coating, wherein the surface comprises a porous or partially hollow geometry and the coating is capable of trapping a fluid between the surface and the coating; and,

allowing a fluid to be trapped between the surface of particulate and the coating so that the density of the particulate is reduced; and

introducing the gravel packing fluid into a well bore so that the reduced-density particulate forms at least a portion of a gravel pack that comprises at least one of the particulates is formed substantially adjacent to the well bore.

42. (Original) The method of claim 41 wherein the coating comprises a resin-type coating material.

43. (Original) The method of claim 42 wherein the resin-type coating material is a consolidation fluid comprising a hardenable resin component comprising a hardenable resin and a hardening agent component comprising a liquid hardening agent, a silane coupling agent, and a surfactant.

44. (Previously Presented) The method of claim 43 wherein the hardenable resin in the liquid hardenable resin component is an organic resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolak resin, polyester resin, phenol-aldehyde resin, urea-aldehyde resin, furan resin, urethane resin, glycidyl ethers, and mixtures thereof.

45. (Previously Presented) The method of claim 43 wherein the liquid hardening agent in the liquid hardening agent component is selected from the group consisting of amines, aromatic amines, aliphatic amines, cyclo-aliphatic amines, piperidine, triethylamine, benzyldimethylamine, N,N-dimethylaminopyridine, 2-(N₂N-dimethylaminomethyl)phenol, tris(dimethylaminomethyl)phenol, and mixtures thereof.

46. (Previously Presented) The method of claim 43 wherein the silane coupling agent in the liquid hardening agent component is selected from the group consisting of N-2-

(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane and mixtures thereof.

47. (Previously Presented) The method of claim 43 wherein the surfactant in the liquid hardening agent component is selected from the group consisting of ethoxylated nonyl phenol phosphate esters, mixtures of one or more cationic surfactants, C₁₂ – C₂₂ alkyl phosphonate surfactants, one or more non-ionic surfactants and alkyl phosphonate surfactants, and mixtures thereof.

48. (Previously Presented) The method of claim 42 wherein the resin-type coating material is a furan-based resin selected from the group consisting of furfuryl alcohols, mixtures of furfuryl alcohol with an aldehyde, mixtures of furan resin and phenolic resin and mixtures thereof.

49. (Previously Presented) The method of claim 48 further comprising a solvent selected from the group consisting of 2-butoxy ethanol, butyl acetate, furfuryl acetate, and mixtures thereof.

50. (Previously Presented) The method of claim 42 wherein the resin-type coating material is a phenolic-based resin selected from the group consisting of terpolymers of phenol, phenolic formaldehyde resin, mixtures of phenolic and furan resin, and mixtures thereof.

51. (Previously Presented) The method of claim 50 further comprising a solvent selected from the group consisting of butyl acetate, butyl lactate, furfuryl acetate, 2-butoxy ethanol, and mixtures thereof.

52. (Previously Presented) The method of claim 42 wherein the resin-type coating material is a HT epoxy-based resin selected from the group consisting of bisphenol A-epichlorohydrin resin, polyepoxide resin, novolac resin, polyester resin, glycidyl ethers, and mixtures thereof.

53. (Currently Amended) The method of claim 52 further comprising a solvent selected from the group consisting of dimethyl sulfoxide, dimethyl formamide, dipropylene glycol methyl ether, dipropylene glycol dimethyl ether, dimethyl formamide, diethylene glycol methyl ether, ethylene glycol butyl ether, diethylene glycol butyl ether, propylene carbonate, ~~d-limonene~~ d-limonene, fatty acid methyl esters, and mixtures thereof.

54. (Original) The method of claim 41 wherein the coating comprises a tackifying coating material.

55. (Previously Presented) The method of claim 54 wherein the tackifying coating material is selected from the group consisting of polyamides, polyesters, polycarbonates, polycarbamates, natural resins, and combinations thereof.

56. (Original) The method of claim 41 wherein the coating comprises a degradable coating material.

57. (Original) The method of claim 56 wherein the degradable coating material comprises a degradable polymer.

58. (Previously Presented) The method of claim 57 wherein the degradable coating material is selected from the group consisting of polysaccharides, chitins, chitosans, proteins, aliphatic polyesters, poly(lactides), poly(glycolides), poly(ϵ -caprolactones), poly(hydroxybutyrates), poly(anhydrides), aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), polyphosphazenes, and combinations thereof.

59. (Original) The method of claim 57 wherein the degradable coating material comprises a stereoisomer of poly(lactide).

60. (Original) The method of claim 57 wherein the degradable coating material comprises a plasticizer.

61.- 80. (Cancelled)